

CHAPTER V. CONCLUSION

A. Conclusion

Based on the research conducted on time series analysis using the ARIMA model to forecast Coffee Productivity in West Sumatra from 2000 to 2023, can be drawn:

1. Although West Sumatra has experienced gradual improvements in coffee productivity in recent years, the overall yield remains below international benchmarks.
2. The best model identified for forecasting Coffee Productivity in West Sumatra is the ARIMA(1,3,0) model. The model chosen based on the significant test and the residual is white noise with MAPE value is 41.23 %, which indicate the models is reasonable to forecast. The forecasted productivity of Coffee in West Sumatra from 2024 to 2028 shows a continuous decline. Productivity is expected to decrease from 1 tons/ha in 2024 to 0.6266 tons/ha in 2025 and further to 0.6125 tons/ha in 2026, followed by a sharp drop to 0.0538 tons/ha in 2027. By 2028, the projected value reaches -0.1709 tons/ha, indicating severe productivity challenges.

B. Recommendation

1. Based on the forecasting of Coffee Productivity in West Sumatra, it is essential for the government to invest in and improve agricultural technology to enhance productivity levels. Consistent and proper fertilization is also necessary to support plant growth and productivity, which depends on the accessibility and affordability of fertilizers.
2. For future research, it is crucial to explore the various factors influencing Coffee Productivity, with a particular emphasis on climate factors and technological advancements. Investigating how climate change impacts crop yields and understanding the role of technology in enhancing resilience can provide valuable insights.

BIBLIOGRAPHY

- Abraham, A.; E. Anim-Kwapong & A. Ofori (2019). Assessment of Genetic Diversity in Robusta Coffee Using Morphological Characters. *International Journal of Fruit Science*, 19(3), 276-299, DOI: 10.1080/15538362.2018.1502723
- [AEKI] Asosiasi Ekspor Kopi Indonesia. (2023). *Komoditas Kopi di Mata Indonesia*. <https://www.aeki-aice.org/komoditas-kopi-di-mata-indonesia/>
- [AEKI] Asosiasi Ekspor Kopi Indonesia. (2024). *Kenaikan Harga Kopi: Dampak dan Prediksi untuk Pelaku Industri*. <https://www.aeki-aice.org/kenaikan-harga-kopi-dampak-dan-prediksi-untuk-pelaku-industri/>
- Agastya, I. M. I., Julianto, R. P. D., & Marwoto, M. (2020). Review: Pengaruh Pemanasan Global Terhadap Intensitas Serangan Kutu Kebul (Bemisia Tabaci Genn) Dan Cara Pengendaliannya Pada Tanaman Kedelai. *Buana Sains*, 20(1), 99–110. doi:10.33366/bs.v20i1.1935
- Anwar & Farida, P. (2015). *Peramalan Bisnis dan Ekonomi*. Buku Ajar. Mataram: Fakultas Pertanian Universitas Mataram.
- Awalina, R., Asmuti, A., Naspendra, Z., & Islami, S. (2022). Strategi Peningkatan Daya Saing Pengembangan Agribisnis Kopi di Sumatera Barat. *Jurnal Riset Perkebunan*, 3(1).
- Balai Besar Litbang Sumberdaya Lahan Pertanian (BBSDLP). 2009. Identifikasi dan Karakterisasi Lahan Rawan Longsor dan Rawan Erosi di Dataran Tinggi untuk Mendukung Keberlanjutan Pengelolaan Sumberdaya Lahan Pertanian. BBSDLP, Bogor.
- Balding, D., Cressie, N. A. C., Fitzmaurice, G. M., Givens, G. H., Goldstein, H., Molenberghs, G., Scott, D. W., Smith, A. F. M., Tsay, R. S., & Weisberg, S. (2016). *Time Series Analysis*. Wiley
- [BPTP] Badan Pengkajian Teknologi Pertanian. (2014). *Teknologi budidaya kopi liberika*. BPTP.
- [BRIN] Badan Riset dan Inovasi Nasional. (2024). <https://www.brin.go.id/press-release/111888/brin-tawarkan-solusi-dongkrak-produktivitas-kopi-di-indonesia>
- Brockwell, P.J. dan Davis, R.A. (1996). Introduction to Time Series and Forecasting. Springer Verlag, New York
- Breusch, T. S., & Pagan, A. R. (1979). A Simple Test for Heteroscedasticity and Random Coefficient Variation. In *Source: Econometrica* (Vol. 47, Issue 5).

- Budiman, A. (2013). *Morfologi tanaman kopi liberika*. Pusat Penelitian Kopi dan Kakao Indonesia.
- Bunn, C., Laderach, P., Ovalle Rivera, O., & Kirschke, D. (2015). A bitter cup: climate change profile of global production of Arabica and Robusta coffee. *Climatic Change*, 129(1–2), 89–101. <https://doi.org/10.1007/s10584-014-1306-x>
- Cambridge (2024). *Meaning of production in English*. Cambridge Dictionary. <https://dictionary.cambridge.org/dictionary/english/production>
- [Central Bureau Of Statistics] Badan Pusat Statistik. (2024). *Berita Resmi Statistik No. 06/01/Th. XXVII, 15 Januari 2024: Perkembangan Ekspor dan Impor Indonesia Desember 2023*. Badan Pusat Statistik Indonesia.
- [Central Bureau Of Statistics] Badan Pusat Statistik. (2024). *Berita Resmi Statistik No. 13/02/Th. XXVII, 5 Februari 2024: Pertumbuhan Ekonomi Indonesia Triwulan IV-2023*. Badan Pusat Statistik Indonesia.
- [Central Bureau Of Statistics] Badan Pusat Statistik (BPS). (2024). *Ekspor Kopi Menurut Negara Tujuan Utama, 2000-2023*. <https://www.bps.go.id/id/statistics-table/1/MTAxNCMx/ekspor-kopi-menurut-negara-tujuan-utama--2000-2023.html>
- [Central Bureau Of Statistics] Badan Pusat Statistik (BPS). (2024). *Data Produksi Tanaman Perkebunan Kopi Arabika dan Kopi Robusca 2004-2022*. <https://sumbar.bps.go.id/indicator/54/714/1/produksi-tanaman-perkebunan-kopi-arabika-dan-kopi-robusca.html>
- [Central Bureau Of Statistics] Badan Pusat Statistik (BPS). (2024). *Data Luas Tanaman Perkebunan Kopi Arabika dan Kopi Robusca 2004-2022*. <https://sumbar.bps.go.id/indicator/54/713/1/luas-tanaman-perkebunan-kopi-arabika-dan-kopi-robusca.html>
- [Central Bureau Of Statistics] Badan Pusat Statistik (BPS). (2024). *Sumatera Barat Province in Figures*. Badan Pusat Statistik Sumatera Barat.
- [Central Bureau Of Statistics] Badan Pusat Statistik (BPS). (2023). *Sumatera Barat Province in Figures*. Badan Pusat Statistik Sumatera Barat.
- [Central Bureau Of Statistics] Badan Pusat Statistik (BPS). (2022). *Sumatera Barat Province in Figures*. Badan Pusat Statistik Sumatera Barat.
- [Central Bureau Of Statistics] Badan Pusat Statistik (BPS). (2021). *Sumatera Barat Province in Figures*. Badan Pusat Statistik Sumatera Barat.
- [Central Bureau Of Statistics] Badan Pusat Statistik (BPS). (2020). *Sumatera Barat Province in Figures*. Badan Pusat Statistik Sumatera Barat.

[Central Bureau Of Statistics] Badan Pusat Statistik (BPS). (2015). *Sumatera Barat Province in Figures*. Badan Pusat Statistik Sumatera Barat.

Cryer, Jonathan D. 1968. *Time Series Analysis*. Boston : PWS Publisher

Cryer, J. D & Chan, k.-S., (2008) *Time Series Analysis : with Application in R* (2nd ed). Springer Science Business Media.

Dinas Pertanian dan Pangan Kabupaten Badung. *Mengenal Tanaman Kopi Robusta*. <https://diperpa.badungkab.go.id/Artikel/18068-mengenal-tanaman-kopi-robusta>

Dinas Pertanian dan Pangan Kabupaten Badung. *Mengenal Tanaman Kopi Liberika*. Source: <https://diperpa.badungkab.go.id/Artikel/18070-mengenal-tanaman-kopi-liberica>

Enders, W. (2014). *Applied Econometric Time Series* (4th ed.). Wiley.

Engle, R. F. (1982). Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of UK Inflation. *Econometrica*, 50(4), 987-1007.

Ferreira, W. P. M., Ribeiro Júnior, J. I., & de Fátima Souza, C. (2019). Climate change does not impact on *Coffea arabica* yield in Brazil. *Journal of the Science of Food and Agriculture*, 99(12), 5270–5282. <https://doi.org/10.1002/jsfa.8465>

Gopinath, M., Sweka, S., & Vishalakshi, S. (2019). Forecasting of Coffee Production in India Using ARIMA Model. *International Journal of Science, Engineering and Management (IJSEM)*, 4(10). <https://www.researchgate.net/publication/338107587>

Gujarati, Damodar. (2004). *Basic Econometrics* Fourth Edition. The McGraw-Hill Companies, New York

Gujarati, D. N., & Porter, D. C. (2009). *Basic Econometrics* (5th ed.). McGraw-Hill/Irwin.

Gusfarina. (2014). *Pengaruh lingkungan terhadap pertumbuhan kopi*. Balai Penelitian Tanaman Industri dan Penyegar.

Hairiah, K., S. Rahayu, D. Suprayogo, dan C. Prayogo. (2016). *Perubahan Iklim : Sebab dan Dampaknya terhadap Kehidupan*. World Agroforestry Centre (ICRAF) dan Universitas Brawijaya.

Hamni. (2013). Potensi Pengembangan Teknologi Proses Produksi Kopi Lampung. *Jurnal Mechanical*, 4(1). <https://journal.eng.unila.ac.id/index.php/mech/article/view/129>

- Hardani, Andriani, H., Ustiawaty, J., Utami, E. F., Istiqomah, R. R., Fardani, R. A., Auliya, N. (2020). *Metode Penelitian Kualitatif dan Kuantitatif*. Yogyakarta: Pustaka Ilmu
- Hasrianti. (2017). *Data Kandungan Gizi Bahan Pangan Pokok dan Penggantinya*. Universitas Hassanudin
- Hulupi, R. (2014). *Karakteristik dan keunggulan kopi liberika*. Pusat Penelitian Kopi dan Kakao Indonesia.
- Husain, M. (2015). *Sistem Pemantau Curah Hujan Dan Tinggi Genangan Air Pada Jalanjalan Yang Rawan Tergenang Di Kota Makassar Melalui Jaringan Internet Pada Aplikasi Android*. UIN Alauddin Makassar
- Hutajulu, H., Mokoginta, M. M., Oka Suparwata, D., Nopriyanti, M., Arahman Erlina Rufaidah, E., Sastro Prawiro, I., Inagama Timisela, S., Radwitya, E., & Adimarta, T. (2023). *Ekonomi Pertanian Peran dan Kontribusi Pertanian dalam Pembangunan Ekonomi*. Penerbit Adab
- Hyndman, R. J., & Athanasopoulos, G. (2018). *Forecasting: Principles and Practice* (2nd ed.). OTexts.
- [ICO] International Coffee Organization. (2023). *April 2023 Coffee Report and Outlook*. International Coffee Organization.
- Indonesia Information Portal. (2023). *Ekspor Pertanian Indonesia Masih Cemerlang*. <https://indonesia.go.id/kategori/editorial/7357/ekspor-pertanian-indonesia-masih-cemerlang?lang=1>
- Iskandar, Yusuf & Sudrajat,. (2014). *Pengaruh Pengetahuan Petani Tentang Multifungsi Lahan Sawah Terhadap Keinginan Petani Mempertahankan Kepemilikan Lahan Sawah Di Koridor Yogyakarta-Magelang*. Universitas Padjajaran.
- Jailani, H. Y. (2019). *Analysis of Factors Affecting Coffee Farmer Behavior in Tanah Datar District*. International Journal of Sciences: Basic and Applied Research, 48(3), 278–290.
- Karyadinata, C., & Pomi, A. P. (2023). Penentuan Lokasi-lokasi Prioritas Pengembangan Pertanian di Kabupaten Bangkalan melalui Analisis Kuadran atas Variabel Luas Lahan, Produktivitas Lahan, Jaringan Irigasi, dan Indeks Pertanaman. *Parjhuga : Jurnal Penelitian Dan Pengembangan Daerah*, 1(2), 79–93. <https://doi.org/10.60128/parjhuga.v1i2.11>
- Karmini, P., Sampul, F., & Karyati.(2018). *Ekonomi Produksi Pertanian*.
- Kementerian Pertanian RI. (2019). *Pelatihan Budidaya Berkelanjutan (Good Agricultural Practices-GAP) dan Pascapanen (Post-Harvest) Kopi Arabika*. www.pertanian.go.id

- Koh, I., Garrett, R., Janetos, A., & Mueller, N. D. (2020). Climate risks to Brazilian coffee production. *Environmental Research Letters*, 15(10). <https://doi.org/10.1088/1748-9326/aba471>
- Maulana, V. (2017). Peramalan Curah Hujan Jakarta Pusat Dengan Metode Sarima (Seasonal Autoregressive Integrated Moving Average). Universitas Andalas.
- Merga, W., & Alemayehu, D. (2019). Effects of Climate Change on Global Arabica Coffee (*Coffea arabica* L) Production. *Greener Journal of Plant Breeding and Crop Science*, 7(1), 23–30. <https://doi.org/10.15580/GJPBCS.2019.1.072319143>
- Montgomery, D.C. (2007). Introduction to Time Series Analysis and Forecasting. John Wiley And Son, Inc, New York
- Mubyarto. (1989). *Pengantar Ekonomi Pertanian*. LP3ES
- Najiyati, S., & Danarti, S. (2004). *Kopi: Budidaya dan penanganan pasca panen*. Penebar Swadaya.
- National Institute of Standards and Technology, 2013. *Levene Test for Equality of Variances*. <https://www.itl.nist.gov/div898/handbook/>
- Nasirudin, F., Pindianti, M., Indah, D., Said, S., & Widodo, E. (2022). Peramalan Jumlah Produksi Kopi Di Jawa Timur Pada Tahun 2020-2021 Menggunakan Metode Seasonal Autoregressive Integrated Moving Average (SARIMA). 25(1). *Agrium*. <https://doi.org/10.30596/agrium.v25i1.8211>
- Nayak, H. G., Reddy, R. S., Rebasiddanavar, R. M., Author, C., & Avinash, G. (2022). Forecasting area, production, and productivity of coffee in Hassan district of Karnataka. *The Pharma Innovation Journal*, 11, 1399–1406. www.thepharmajournal.com
- Nguyen, G. N., & Sarker, T. (2018). Sustainable coffee supply chain management: a case study in Buon Me Thuot City, Daklak, Vietnam. *International Journal of Corporate Social Responsibility*, 3(1), 1-17.
- Nurmala, Aisyah D. Suyono, et all. (2012). *Pengantar Ilmu Pertanian*. Yogyakarta: Graha Ilmu
- Paloma, C., & Yusmarni. (2020). *Pengaruh Aksesibilitas Pembiayaan Terhadap Pendapatan Petani Kopi Di Lembah Gumanti, Kabupaten Solok*. Jurnal Agrisep, 19(2), 301–314. <https://doi.org/10.31186/jagrisep.19.2.301-314>
- Paloma, C., Hakimi, R., & Indah Mutiara, V. (2023). *Kajian Keragaan Petani Kopi Solok Radjo Di Kecamatan Lembah Gumanti Kabupaten Solok*. Jurnal Pertanian Agros, 25(2).

- Panggabean, E. (2011). *Buku Pintar Kopi*. Agro Media Pustaka
- Pankratz, A. (1991). *Forecasting with Dynamic Regression Models*. John Wiley and Sons, Inc.
- Pedoman Produksi, Sertifikasi, Peredaran dan Pengawasan Benih Tanaman Kopi (Coffee spp), Pub. L. No. 27/Kpts/KB.023/05/2021, 1 (2021).
- Putri, A., Yusmarni, Y., Paloma, C., & Zakir, Z. (2018). *Kinerja Faktor Produksi Kopi Arabika (Coffea arabica L.) di Lembah Gumanti, Kabupaten Solok, Sumatera Barat*. *Industria: Jurnal Teknologi dan Manajemen Agroindustri*, 7(3), 189–197. <https://doi.org/10.21776/ub.industria.2018.007.03.7>
- Putri, A., Rahmat, S., Hasnah, H., & Miko, A. (2024). *Correlation of Knowledge, Attitudes, and Actions of Coffee Farmers in Implementing Good Agriculture Practice (GAP) in Solok District*. *Jurnal Sosial Ekonomi Pertanian*, 16(3), 227. <https://doi.org/10.19184/jsep.v16i3.42990>
- Putri, A., Paloma, C., & Zakir, Z. (2018). *Kinerja Faktor Produksi Kopi Arabika (Coffea arabica L.) Performance of Production Factors of Arabica Coffee (Coffea arabica L) in Lembah Gumanti, Solok Regency, West Sumatera. Jurnal Teknologi Dan Manajemen Agroindustri*, 7, 189–197. <https://doi.org/10.21776/ub.industria.2018.007.03.7>
- Pusat Data dan Sistem Informasi Pertanian. (2023). *Analisis kinerja perdagangan komoditas kopi* (Vol. 12 No. 2D). Sekretariat Jenderal, Kementerian Pertanian. <https://satudata.pertanian.go.id>
- Raharja, A. (2010). *Peramalan Penggunaan Waktu Telepon Di Pt . Telkomsel Divre 3 Surabaya. SISFO Jurnal Sistem Informasi*.
- Rahardjo P. (2012). *Paduan Budi Daya dan Pengolahan Kopi Arabika dan Robusta*. Penebar Swadaya
- Rahardjo, S. (2017). *Taksonomi tanaman kopi*. Fakultas Pertanian, Universitas Gadjah Mada.
- Rahmawati, Y.F., Zukhronah, E., dan Pratiwi, H. (2021). *Penerapan Model ARIMA-ARCH untuk Meramalkan Harga Saham PT Indofood Sukses Makmur Tbk. Business Innovation and Entrepreneurship Journal*. Vol. 03(03), 171-177.
- Rezaldi, A.D. (2021). *Peramalan Metode ARIMA Data Saham PT. Telekomunikasi Indonesia. Prosiding Seminar Nasional Matematika*, pp. 611–620. <https://journal.unnes.ac.id/sju/index.php/prisma/>
- Rosyidi, Suherman. (2006). *Pengantar Teori Ekonomi: Pendekatan Kepada Teori Ekonomi Mikro dan Makro*. PT Raja Grafindo Persada.

- Ruswanti, D. (2020). Pengukuran Performa Support Vector Machine Dan Neural Network Dalam Meramalkan Tingkat Curah Hujan. *Gaung Informatika*, 13(1).
- Sagita, T., & Dwi Ratna Hidayati. (2013). Keragaan Kopi di Pasar Domestik Indonesia. *Agriekonomika*, 2(2007), 49–57.
- Saputri, W., & Amalita, N. (2020). Analisa Tentang Luas Tanam dan Luas Panen di Bidang Komoditi Perkebunan di Provinsi Sumatera Barat dengan Menggunakan Analisis Profil. *UNPjoMath*, 3(1). <https://ejournal.unp.ac.id/students/index.php/mat/article/download/8917/3979>
- Sarwono, J. (2006) *Metode penelitian kuantitatif & kualitatif*. Graha Ilmu.
- Schmidt-Thome, P., Nguyen, T. H., Pham, T. L., Jarva, J., & Nuottimäki, K. (2015). Scenario Workshops. *Climate Change Adaptation Measures in Vietnam* Springer, Cham. 69-77. https://www.researchgate.net/publication/316137952_Climate_Change_Adaptation_Measures_in_Vietnam
- Soejoeti, Z. 1987. *Analisis Runtun Waktu*. Jakarta. Karunika.
- Sudarmo A. E. Sianturi, Emy Kernalis dan Aprillita. 2016. Analisis Produktivitas Usahatani Padi Sawah Di Kecamatan Beak Kabupaten Tanjung Jabur Timur. *Jurnal Pertanian*. Respository Universitas Jambi. Vol 5(2). 1-13.
- Sugiarto & Harijono. (2000). *Peramalan Bisnis*. PT Gramedia Pustaka Utama.
- Supranto, J. (2001). *Statistik: Teori dan Aplikasi*. Jakarta: Erlangga.
- Suprayitno, Eko. (2008). *Ekonomi Mikro: Perspektif Islam*. Maliki Press.
- Syaifurrahman, M. A., Miftahur, D., & Akbar, R. (2021). *Warta Kopi Robusta (Coffea canephora) di Garis Terdepan Menghadapi Perubahan Iklim Global*. Pusat Penelitian Kopi dan Kakao Indonesia.
- Taib and Purnama Dini Hari, G. (2019). Analisis Rantai Pasok Dan Pemasaran Biji Kopi Di Sumatera Barat. *Jurnal Teknologi Pertanian Andalas*. 23(1).
- Tantika, H. N., Supriadi, N., & Anggraini, D. (201). Metode Seasonal ARIMA untuk Meramalkan Produksi Kopi Dengan Indikator Curah Hujan Menggunakan Aplikasi R di Kabupaten Lampung Barat. *Jurnal Teori dan Terapan Matematika*, 17(2). <https://ejournal.unisba.ac.id/index.php/matematika/article/view/3831>
- Taskia Dewanti, R., Zukhronah, E., Sulandari, W. (2024). *Peramalan Harga Saham Pt Indofood Sukses Makmur Tbk Menggunakan Model Hibrida Singular Spectrum Analysis (Ssa)-Autoregressive Integrated Moving Average (Arima)*. 13(2), 270–279. <https://doi.org/10.14710/j.gauss.13.1.270-279>

- Thamrin, S. (2014). *Faktor-Faktor yang Mempengaruhi Produksi Usahatani Kopi Arabika di Kabupaten Enrekang Sulawesi Selatan*. Agruc, 26(1), 1–6.
- Thamrin, S., Hartono, S., Darwanto, D. H., & Fakultas Pertanian, U. G. (2015). *Efisiensi Teknis Usahatani Kopi Arabika di Kabupaten Enrekang*. Ilmu Pertanian, 18(2), 92–97.
- Undang-Undang Republik Indonesia Nomor 31 Tahun 2009 Tentang Meteorologi, Klimatologi, Dan Geofisika.
- Wang, Xunming & Chen, Fahu & Dong, Zhibao. (2006). The relative role of climatic and human factors in desertification in semiarid China. Global Environmental Change. *Global Environmental Change Journal*, 16(2).
- Wei, William W.S. (1990). *Time Series Analysis: Univariate and Multivariate Methods*. Addison Wesley, Canada
- Wei, William W.S. (2006). *Time Series Analysis: Univariate and Multivariate Methods*. Addison Wesley.
- Wooldridge, J. M. (2013). *Introductory Econometrics: A Modern Approach* (5th ed.). South-Western Cengage Learning.
- Yudaruddin, R. (2019). *Forecasting untuk Kegiatan Ekonomi dan Bisnis*. RV Pustaka Horizon.
- Yuliandri, M. Triesna. (2015). *Sejarah “First, Second and Third Wave Coffee.” Majalah Otten Coffee*. <https://majalah.ottencoffee.co.id/sejarah-first-second-and-third-wave-coffee/>
- Yusmarni, Y., Putri, A., Paloma, C., & Yusmarni, Y. (2020). *Marketing performance of Kopi Solok Radjo in industrial revolution 4.0*. IOP Conference Series: Earth and Environmental Science, 497(1). <https://doi.org/10.1088/1755-1315/497/1/012044>
- Zhang, T., Wang, K., and Zhang, X. 2015. Modelling and Analyzing the Transmission Dynamics of HBV Epidemic in Xinjiang, China. *Plos One*. Vol. 10(9), 110-121